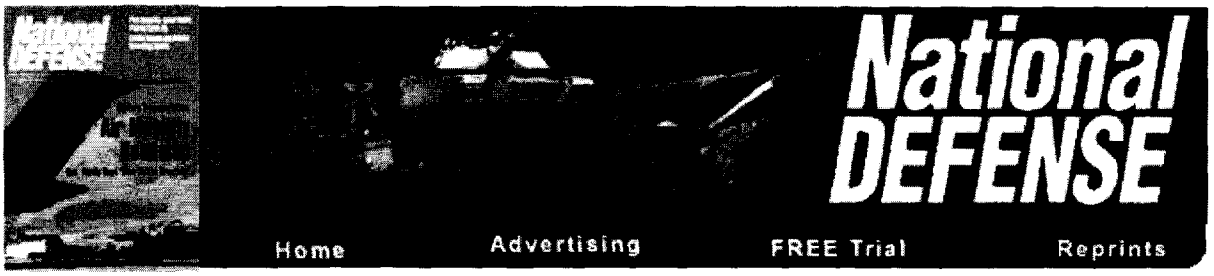


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*Feature Article*

# U.S. Combat Rescue Radio Survives Trying Tests

**Commercial technologies are simpler to use and cheaper, say manufacturers**

**by Sandra I. Erwin**

The next-generation survivor radio for U.S. military pilots has completed several key tests in recent months. Programs officials said that the radio has overcome serious development problems experienced three years ago and that the technology will work as planned.

The CSEL (combat survivor/evader locator)—conceived as a replacement for the PRC-90 and PRC-112 radios—would help recovery units to pinpoint the location, authenticate and establish communications with downed aircrew in need of extraction.

The Pentagon's budget for fiscal year 2003 includes $50 million for the procurement of 3,500 CSEL radios. The 2002 budget was $30 million. Through 2015, the plan is to buy up to 53,000 units for the Army, the Navy and the Air Force. The manufacturer is the Boeing Company.

The CSEL radio will enable two-way, over-the-horizon encrypted communications, so downed aviators can exchange messages with rescue coordination centers around the world.

The handheld radio—with an embedded GPS satellite receiver—is only one piece of an elaborate command-and-control network envisioned for CSEL. The system will include four dedicated UHF (ultra-high frequency) satellite base stations for two-way secure communications with the users, and other ground-based search-and-rescue sites that process information. Two of the four UHF base stations will be located in the United States (Hawaii and Virginia) and two in Italy (Naples and Sicily). These facilities currently are

U.S. Navy UHF satellite communications centers. They provide a conduit for the radio signals to be transmitted over the horizon and fed into the existing secure military networks.

Air Force Col. (Sel.) David Madden, CSEL program manager, said in a recent interview that the system has performed well in tests this year, and that his most significant challenge in the months ahead is the training of the CSEL operators.

The Air Force is responsible for the CSEL program management on behalf of all the services. But, as a result of development glitches that plagued the program in 1998, the Defense Department's Operational Test and Evaluation (DOT&E) office was asked to oversee the project.

In his fiscal 2001 annual report, DOT&E director Thomas Christie said that the CSEL technology is "potentially effective and suitable." But he cautioned that it's not ready for operational use, because there are important issues about CSEL fielding and operator training that have yet to be worked out with the services and the U.S. regional war-fighting commanders.

According to Christie, some "users, trainers, testers and acquisition personnel ... have not been involved in the program enough. ... Concept of operations, fielding, manning, training and support have been slighted in the rush to produce a 'radio.'"

The program's aggressive schedule, Christie said, has kept CSEL "on the leading edge of technology." As a result, "the technology at times has been too immature for the users to field."

Madden said he was not familiar with the DOT&E report, so he could not comment on it.

The next major milestone in the program is a multi-service operational test and evaluation (MOT&E), scheduled for October, he said.

In April and May 2002, the CSEL program office conducted tests with Army troops at Fort Huachuca, Ariz., and with Air Force units in Alaska.

The tests in Alaska focused on cold weather and SARSAT (Search And Rescue Satellite Aided Tracking) mode operations. In latitudes above 72 degrees North and below 72 degrees South, the UHF satellites don't provide wide enough coverage, so CSEL must rely on signals from the international SARSAT system, Madden explained.

During the tests, he said, the "radio worked well. ... The issue is training operators. The challenge was teaching the users."

In early May, CSEL was tested at sea, on the USS Lincoln aircraft carrier, 200 miles off the coast of San Diego. "We had a recovery work station on board the ship," said Madden. "We dropped off survivors on San Clemente Island and ran a full rescue."

Madden admitted that there were "minor errors over the four tests," but he is

working to "make sure our training program is solid."

The MOT&E in October will include 12 major events. Between 15 October and 1 November, there will be a full-blown exercise for all the services.

Pentagon approval for full-rate production could come as early as May 2003, said Madden. He said the radio costs about $9,000. The contractor, he added, will try to get the price down to $6,000 to $7,000, "when we increase the quantities."

This month, Boeing is scheduled to deliver the first lot of 376 radios—288 for the Air Force and 88 for the Army. By March 3002, the company is expected to ship about 1,300 radios—900 to the Army and the rest to the Navy.

The naval aviation CSEL variant had experienced the most technical problems, because it was not adequate for seawater operations, so the service cancelled its CSEL funding in 2001. Now that the problems have been fixed, said Madden, the Navy has reinstated the funds.

The $50 million budgeted in 2003, he said, is "evenly spread among all services."

The CSEL program office is trying to get the services to accelerate the funding so they can buy all 53,000 radios before 2015. Madden said that 30,000 of the radios will be bought by 2007.

Over the course of the entire production run, the Army will receive 18,500, the Navy 15,000, Navy special warfare 1,600 and the Air Force 17,000.

Madden explained how CSEL would be used in a typical rescue mission:

Before the mission, the radio is loaded with data about the theater, maps, personnel data, GPS

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coordinates and encryption keys. "The rescue center knows everything about the pilot," said Madden.

If the plane crashes and the pilot ejects and survives, once he is on the ground, he pushes a button on the radio. A UHF signal goes up to a satellite orbiting 22,000 miles above the earth. The signal then goes back down to one of the four base stations. Only two are operational today.

The pilot's message travels via the Pentagon's classified network, the SIPRNET, to a joint rescue center. An acknowledgment message is sent back to the pilot. The pilot then must authenticate his identity and respond to questions with "yes" and "no" answers in text format. A typical question, said Madden, would be "Are you hurt?"

Messages are exchanged while the rescue center tries to figure out his location. "When we get to the point we are going to pick him up, the pilot can

shift to a VHF mode for voice communications with the recovery aircraft." Pilots carry a map and a compass, just in case GPS is jammed.

The two-way communications and over-the-horizon capability are CSEL's biggest advantages over the existing radios and interrogator systems, said Madden.

"In the tests, we found the downed pilot within three minutes," he said. "We know exactly where he's at." Eventually, said Madden, CSEL could help turn search-and-rescue operations into "no search, all rescue."

In most SAR operations, he noted, "our problem is that we don't know where the guy is, within 100 miles. So we end up sending 100 planes to look for him."

The voice channel in CSEL has a 50-mile range. But Madden said he hopes that downed pilots will refrain from using voice and rely more on the text messages, to avoid being located by the enemy. "We are trying to get these guys off voice," he said. "They are used to all voice with the current system. ... We want them to use the over-the-horizon capability, which has low probability of being intercepted."

One of the most technically challenging components that had to be developed for CSEL was the battery. Most of the radio's 32-ounce weight is the battery, said Madden. The lithium-magnese-dioxide battery survives in -20 degrees Centigrade temperatures and is water submersible, he said. It has a life of about 10 days.

The CSEL office developed two batteries. A non-rechargeable, "prime mission battery" and another one that is rechargeable. Some of the

services were concerned about the cost of the batteries, "so we developed a rechargeable." All services are considering buying a mix of the two, said Madden.

Commercial Radios

Technical problems and delays in the CSEL program, meanwhile, have spurred manufacturers to release upgraded GPS-based search-and-rescue radios that can fill in the gap until CSEL is fielded.

The maker of the PRC-112, General Dynamics Decision Systems, received a $10 million Navy contract earlier this year to upgrade 1,422 AN/PRC-112B1 aircrew survival radios. Dede Connors, the company's marketing manager, said the upgrade involves the addition of a GPS appliqué and encrypted two-way messaging.

The AN-PRC-112B1 costs $11,000, said Connors. General Dynamics recently introduced a redesigned version with embedded GPS, called GPS-112, which costs $8,000.

The GPS-112 will be ready for deliveries in late 2002, she said. The target customers are the Defense Department and NATO countries.

The 112B1 radio is part of the so-called Hook 2 combat search and rescue (CSAR) system, which includes the AN/PRC-112B1 radio and the Quick Draw 2 interrogator. Most rescue aircraft have the Quick Draw 2 interrogator, Connors said.

"When someone goes down, the aircraft looking for them has to have a system on board to interrogate the radio, to gather information from the radio," she said. "Preset messages are loaded that tell rescuers about the condition of the fallen crew and the environment—as well as identify the particular radio. That message is an encrypted data burst."

Connors said that she does not view the GPS-112 as a competitor to CSEL. "They are both likely to co-exist in the Defense Department portfolio," she said. "GPS-112 is less expensive and less difficult to use. It's compatible with the 25,000 PRC-112 radios in use today."

An undisclosed Defense Department customer already has ordered the GPS-112, she said.

Another competitor in the CSAR radio market is Israel's Tadiran Spectralink Ltd. The company has a partnership with the Tobyhanna Army Depot, in Pennsylvania, to upgrade the older PRC-112 A/B/C models into a C version, for the U.S. Army. Tadiran also received a $7.5 million Navy contract recently for 3,662 personal locator beacon/voice transceivers, 400 emergency locator transmitters and 20 training radios for Navy aircrew survival gear. The equipment will be manufactured in Tallahassee, Fla.

Tadiran's latest offering is the advanced search and rescue system (ASARS-G), with embedded GPS. It consists of the ARS-700G interrogator and guidance system and the handheld PRC-434G personal survival radio. The system has a digitally encrypted data link channel at all available frequencies.

Avi Halel, Tadiran's business development director, said that his company's technology is more advanced than the GPS-112, because it provides longer range.

In various tests, said Halel, the ASARS-G demonstrated a range of nearly 100 miles, more than double what competitors offer. The extended range is attributed to the additional power in the radio (2 watts) and more sensitivity overall, Halel said.

At least two countries have bought the PRC-434 radio, but Halel said he could not name them.

The PRC-434 is not meant to compete with CSEL, he said, since the U.S. Defense Department already is financially committed to CSEL. However, he said, "CSEL had a lot of problems. That is why Navy and Army came to us."

Ultimately, said Halel, "we can offer PRC-434 if CSEL doesn't work.

Madden, the CSEL program manager, said that the commercial systems don't really stand a chance against the U.S. military radio. "There is nothing even close to the capability of CSEL."

In Madden's opinion, "People are overselling. ... You can take a 112 and put a GPS receiver. [But] You don't have over-the-horizon capability, access to the national systems, the battery life that we have."

It is interesting to observe, however, that the commercial radio makers are upgrading the systems to be more like CSEL, said Madden. "Systems are evolving toward a CSEL. Almost all the plans I see, that is what they are doing."

Vendors have been taking advantage of the technical problems in CSEL to sell their products, he said. But those days are over. "The senior leadership now is convinced that CSEL is on track. So we are not messing around with any other system."

It is not clear yet whether CSEL will be compatible with the Defense Department's Joint Tactical Radio System, a program designed to replace every military radio with a standard software-based JTRS terminal.

An industry source said that JTRS-CSEL compatibility would be hard to achieve, because CSEL was started before JTRS became a requirement for military radios and because CSEL is not a software-based radio. "It would not be technically difficult, but it would be programmatically difficult, because it would take time and money to modify a radio to do the CSEL function, with the JTRS software base, as opposed to a hardware base," the source said. "It's a question of cost and value to the government."